620 COMMON TRUNK SWITCHING EQUIPMENT

This publication is a general functional description of the 620 series of common trunk switching equipment, including the 620-301 and -302. While the information contained herein may be helpful to the operator or programmer, this publication is not intended as a replacement for NCR Century programming or operating manuals.

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INTRODUCTION

GENERAL INFORMATION

The 620 series of common trunk switching equipment includes the 620-301 common trunk switching unit, the 620-302 central switch control unit, and three types of common trunk switch. The switches are called modules.

The common trunk switching modules used in the 620 series are designed to interface only with processors and level 1 peripherals (devices that connect directly to the common trunk). The modules cannot interface with level 2 peripherals.

The switching modules must be activated by pushbutton control, and cannot themselves be operated as peripherals.

EQUIPMENT DESCRIPTION SUMMARY

Switching is done electronically rather than mechanically. This means that connections are established and broken by logic circuits rather than by the mechanical motion of switch parts. Two modules can be accommodated in either unit, and can be controlled by pushbuttons on the control panel of the cabinet in which they are mounted, or by remote control. Individual system requirements determine the number and types of switching modules supplied with the units.

Switching Modules

Three types of modules are available for use in the 620-301 and 620-302:

- 2 x 1 Module

  The 2 x 1 module can be used to move one or more level 1 peripherals between two processors or between trunks on a processor.

- 2 x 2 Module

  The 2 x 2 module is used to interchange the connections between two processors and two or more level 1 peripherals.

- 1 x 2 Module

  The 1 x 2 module can be used to connect either of two level 1 peripherals to one position on the common trunk.

Detailed explanations of the uses of each type of switching module are given later in this publication.

Switching and Control Units

The two models of the switching and control units provide housing for the switching modules.

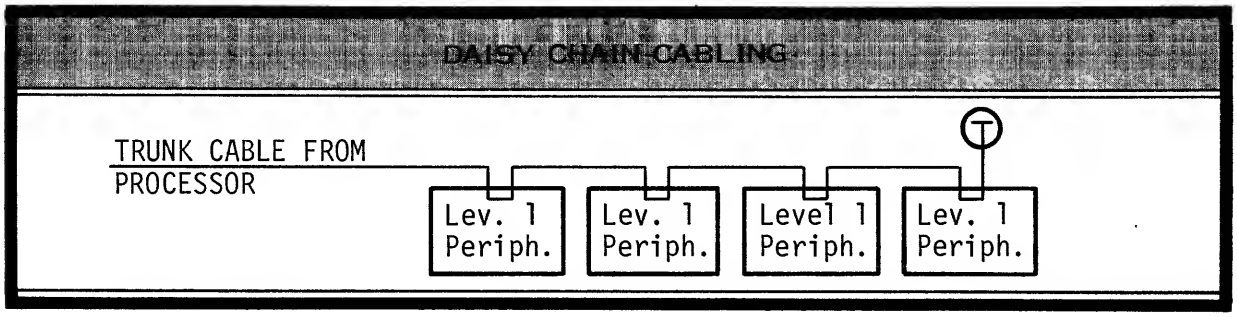
The 620-301, the simpler of the two, includes power and cabinetry for two common trunk switching modules, panel controls to operate the modules, and panel-mounted indicators.

The 620-302 is essentially a 620-301 factory-modified to include facilities for remote control of switching modules mounted in other 620 cabinets. The 620-302 also includes indicators that present the status of all the switching modules connected to it.

COMMON TRUNK RESTRICTIONS

The term common trunk refers to a design philosophy rather than to the cable used to connect peripheral units to the processor. This design philosophy is called the common trunk because it standardizes the I/O operations of the various types of peripheral units and because it provides a set of standard trunk electronic characteristics. This means that all of the functional differences inherent in the different types of peripheral units are resolved within the peripheral units themselves rather than in the processor. That is why the trunks to which the peripheral units are connected are called common trunks; they are common because the same trunk characteristics are presented to all of the peripheral units. The result of this commonality is that the processor can treat all peripherals in exactly the same way.

All of the peripheral units on a trunk are connected to all of the lines in the trunk. The peripherals are, in effect, connected in parallel, although they are isolated from each other by logic networks. The actual connection of the peripherals to the trunk is arranged in what is called the "daisy chain" arrangement. This method of cabling is illustrated in the sketch below.



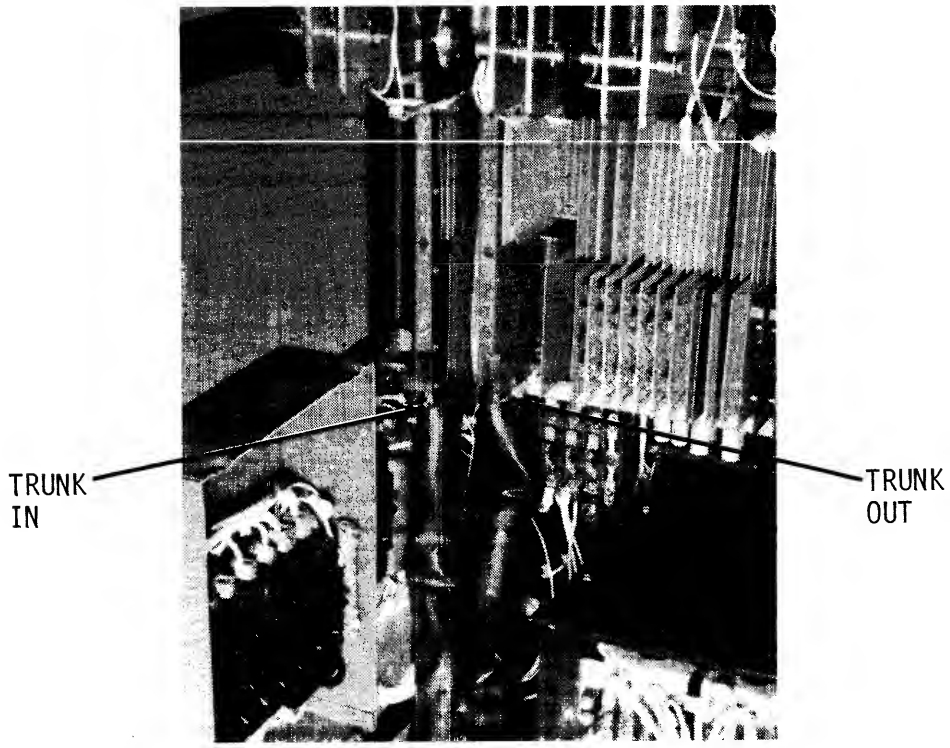
In this arrangement, the trunk appears to pass through each peripheral unit. Physically, it does; electrically, it does not. The cable enters each unit and is connected to that unit by a plugboard connector; it leaves the unit through another plugboard connector, as shown in the photo on page 5. The (T) shown at the end of the trunk in the sketch above is a special trunk terminator that must be installed whenever a trunk is to be ended in a peripheral unit rather than continued on to another unit; the terminator must also be installed in the 620 switching equipment whenever a trunk segment ends in a 620 unit.

Each trunk can accommodate up to eight level 1 peripheral units. A level 1 peripheral unit is one which connects directly to the common trunk. A level 2 unit is one which connects to the trunk through a level 1 unit. Magnetic

tape units, for example, are level 2 units; they connect to the trunk through a magnetic tape control unit, which is a level 1 peripheral. Each level 1 unit occupies one position on the common trunk. A unit's position number is a logical number rather than a physical position, and is determined by a small logic card in the peripheral unit itself. Thus, when units are switched from trunk to trunk by means of the 620 equipment, they take their position numbers with them. In the sketch on page 6, for example, the level 1 peripheral unit can be moved from position 4 of trunk A to position 4 of trunk B.

This position numbering procedure places some restrictions on the ways in which units can be moved with the 620 equipment, because duplicate position numbers are not permitted on the same trunk. If two units on a trunk had the same position number, both would respond to all attempts to select either unit.

The units carry not only their position numbers with them, but also their response numbers. The response numbers, which the I/O control uses to calculate the addresses of the units' control words, are determined by logic cards similar to those used for position numbers. Care must be exercised to avoid confusion of control words. If, for instance, a unit uses control word 23 on processor A, and is switched to processor B, it must be given the same control word in the second processor.



TRUNK CONNECTIONS IN A PERIPHERAL UNIT

NOTE

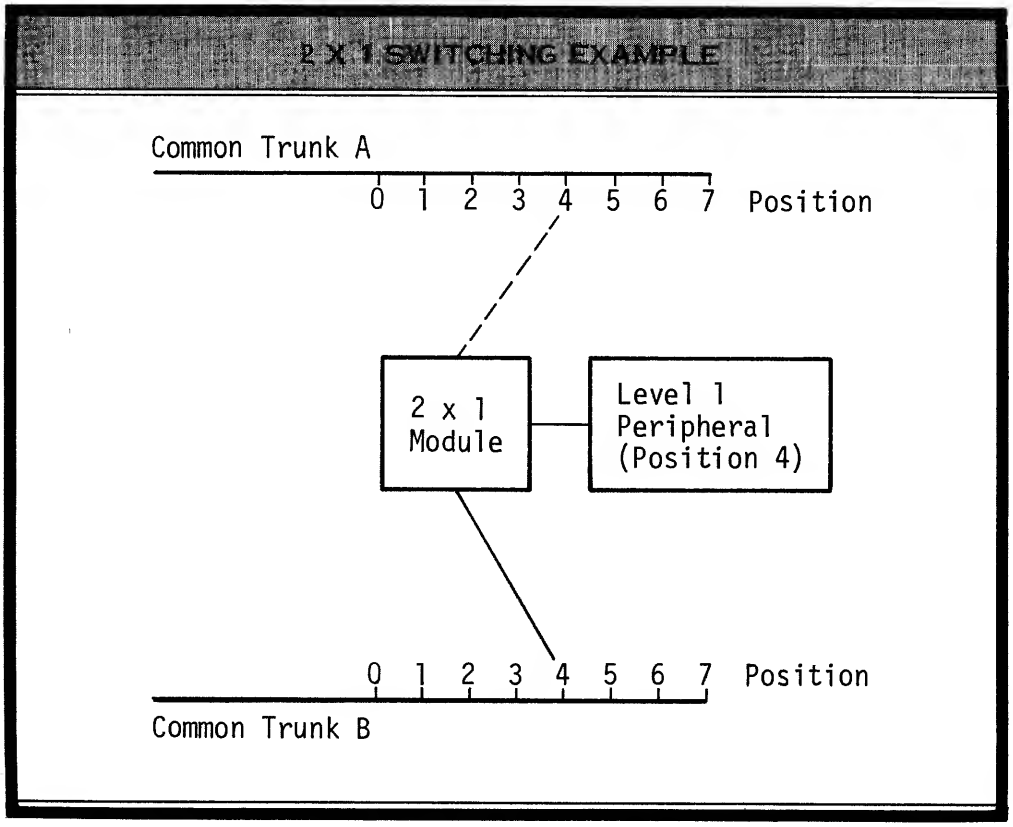
The unit shown in the photograph is a 660-101 paper tape reader partially disassembled. Details of trunk connections vary somewhat in different types of peripherals.

COMMON TRUNK SWITCHING MODULES

The general uses for the three types of common trunk switching modules were given in the introduction. This section discusses in detail the uses and function of each type of module. Explanations of the units in which the modules are housed are given in the next section.

2 x 1 MODULE

The function of the 2 x 1 switching module is shown in the sketch below:



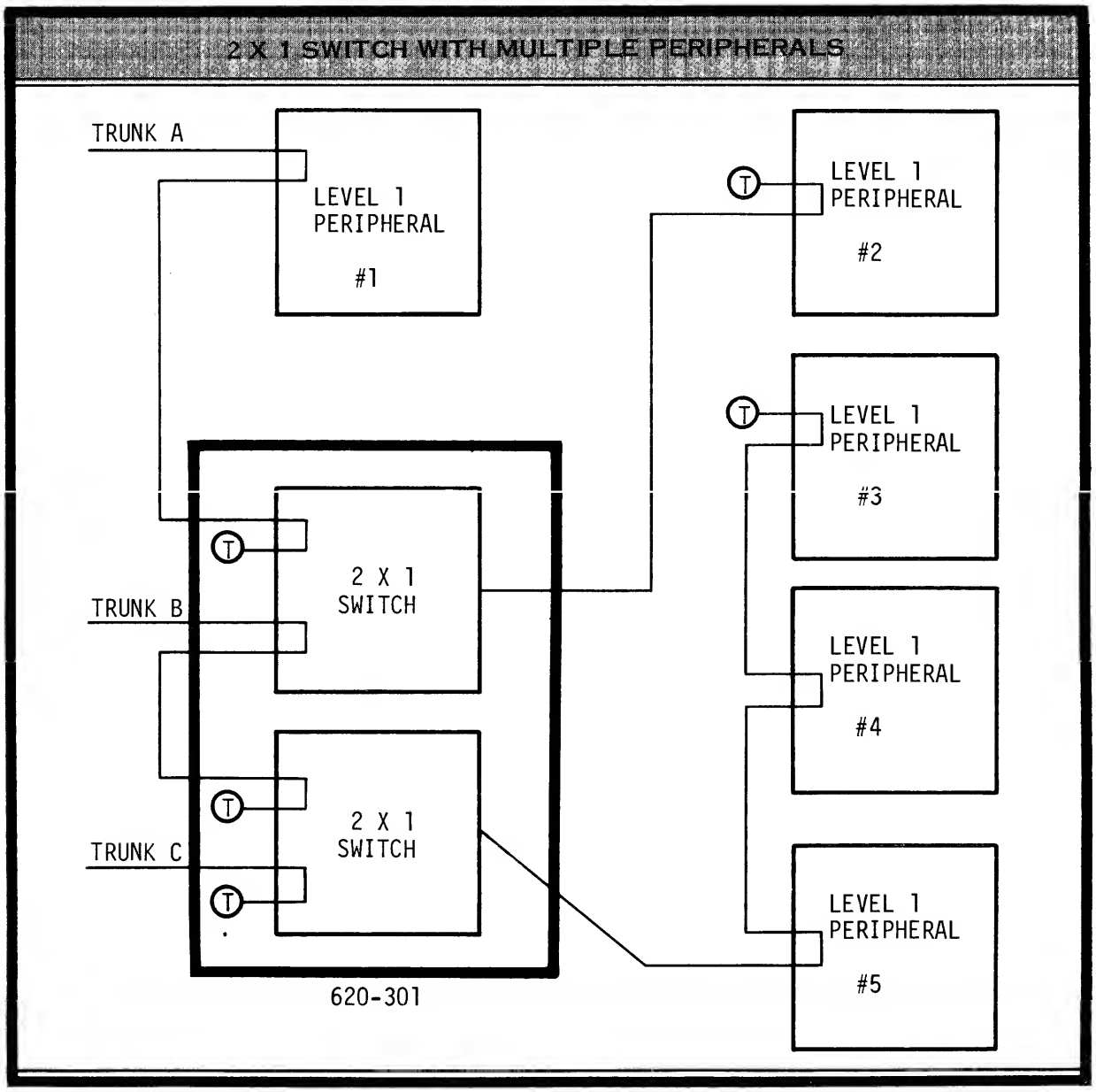
The 2 x 1 module connects the level 1 peripheral to trunk A or to trunk B. Trunks A and B can be trunks from the same processor or from different processors. The level 1 peripheral could be any level 1 peripheral, including a control unit or a communications multiplexor.* The unoccupied trunk position (position 4, trunk A in the example) is not affected by the presence of the switching circuit; it is simply an unused trunk position.

The 2 x 1 module could be used to switch a communications multiplexor from a main processor to a backup processor in the event of an equipment failure, or for any other application that required the moving of a peripheral or a string of peripherals from one trunk to another.

* The B2 operating system requires that a multiplexor be assigned to position 7 of whatever trunk it occupies.

2 X 1 MODULE WITH MULTIPLE PERIPHERALS

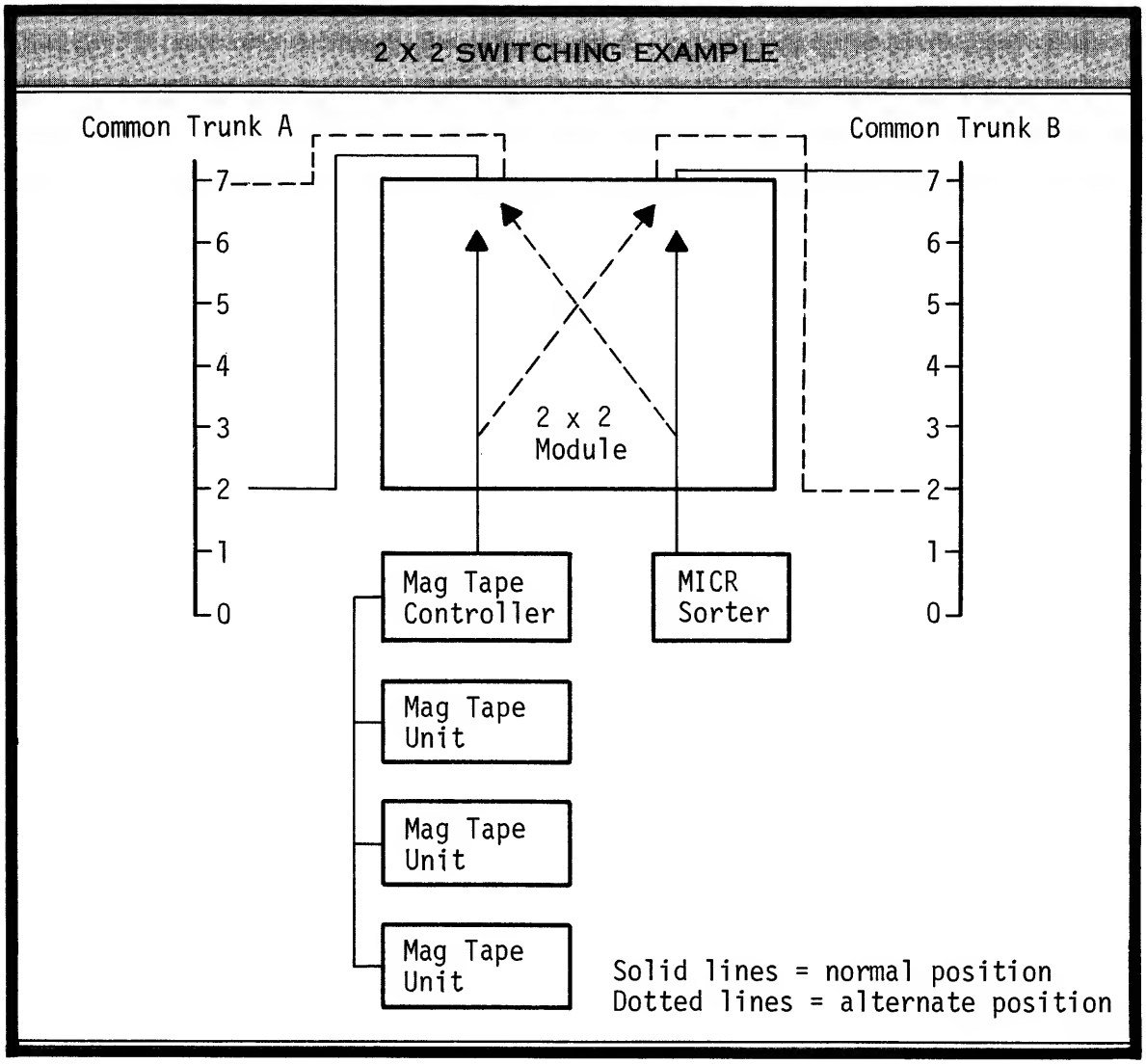
The 2 x 1 module can be used to switch not only single level 1 peripherals but also strings of level 1 peripherals. The example below, which includes five peripherals, two 2 x 1 switches, and three trunks, suggests the degree of flexibility that can be achieved with the 2 x 1 module. Both 2 x 1 switches are shown housed in the same 620-301 switching unit. They need not be, and could be elements of a much larger, more complex system, and could be mounted in separate units.



In this system, peripheral number 1 is always connected to trunk A. Peripheral 2 can be connected to trunk A or to trunk B. Peripherals 3, 4, and 5 can be connected to trunk B or to trunk C.

2 x 2 MODULE

The function of the 2 x 2 module is shown in the sketch below:



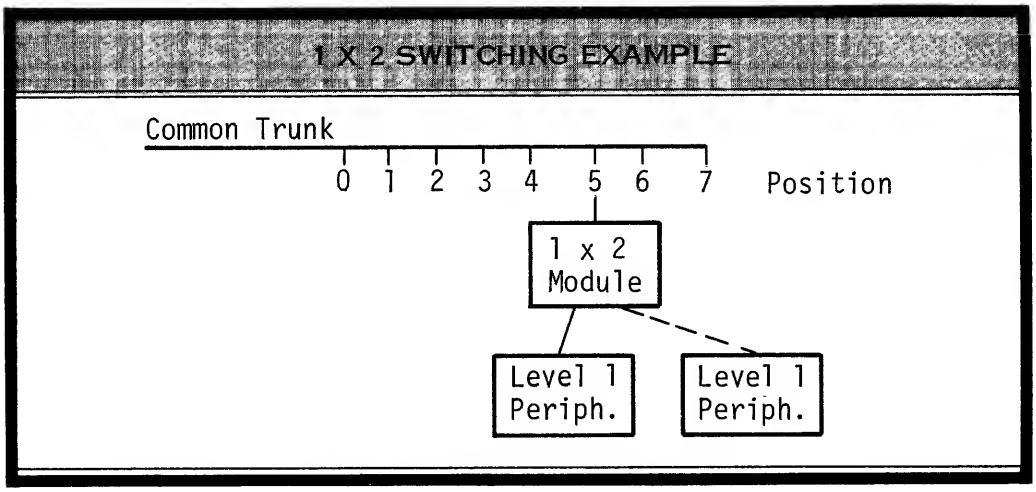
The 2 x 2 module is used to interchange the connections between any two trunk positions and any two level 1 peripherals. In the sketch above, the MICR sorter is shown connected to position 7 of trunk B, and the magnetic tape controller to position 2 of trunk A. When the switching module is actuated, the connections will be reversed, with the MICR sorter at position 7 of trunk A and the magnetic tape controller at position 2 of trunk B.

Trunks A and B can be trunks from the same processor or from different processors.

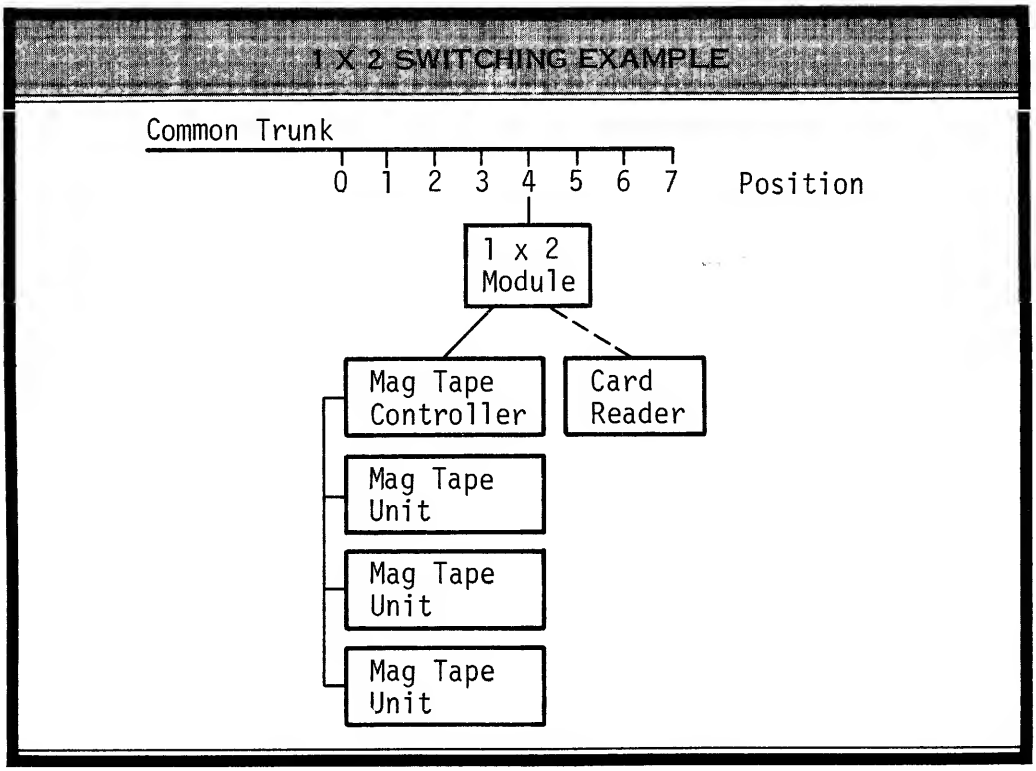
The 2 x 2 module can be used to swap any two peripherals between any two trunk positions whenever it is necessary to change the equipment arrangement.

1 x 2 MODULE

The function of the 1 x 2 module is shown in the sketch below.

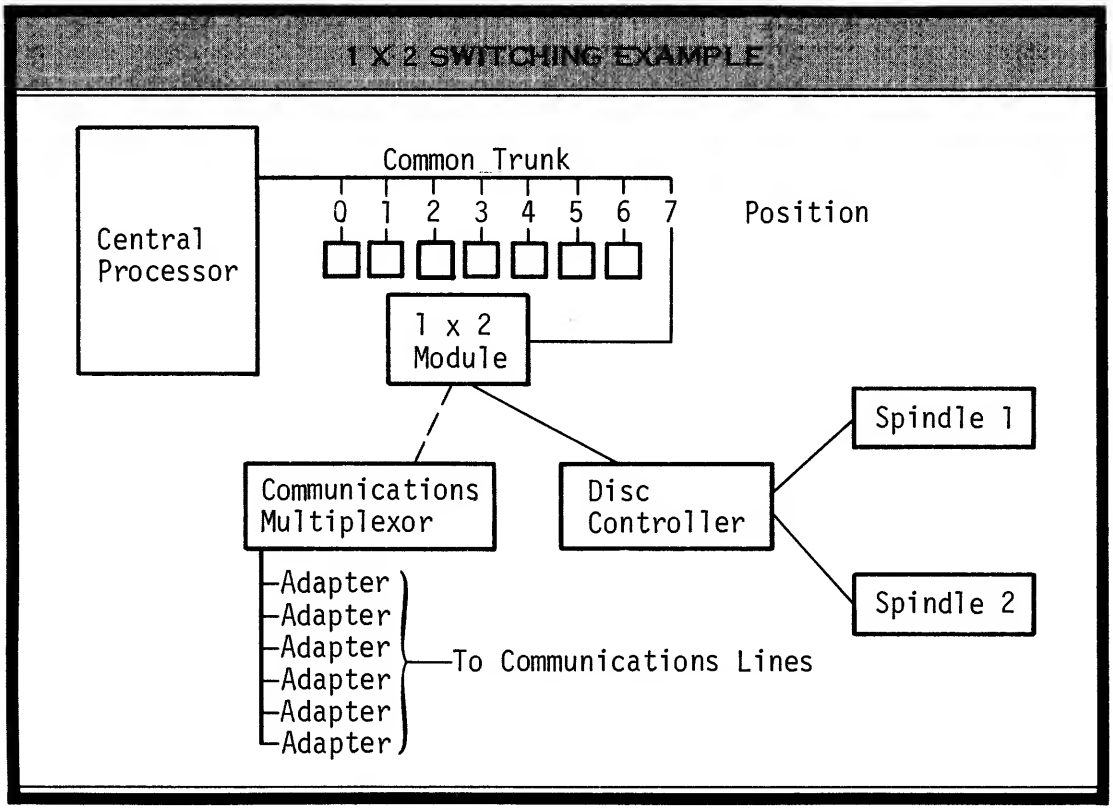


In this arrangement the 1 x 2 module connects one of the two level 1 peripherals to position 5 of the trunk shown. If one of the two peripherals in the sketch above were a magnetic tape controller, and the other a card reader, the trunk might be arranged thus:



This arrangement would allow the operator to use the card reader during one program run and to then replace it with the three magnetic tape units upon the conclusion of the run.

The 1 x 2 module could be used to disconnect a communications multiplexor from the common trunk, and to replace it with some other peripheral required after communications operations were terminated. Such a procedure, which might be followed at the close of a business day, when the communications facilities were no longer required, is illustrated in the sketch below.



When the multiplexor is in operation, no other peripherals can be operated on the trunk used by the multiplexor. Thus, the use of the 1 x 2 switching module to remove the multiplexor from the trunk frees the trunk not only for the disc control unit shown above, but also for all of the peripherals connected to positions 0, 1, 2, 3, 4, 5, and 6.

NOTE

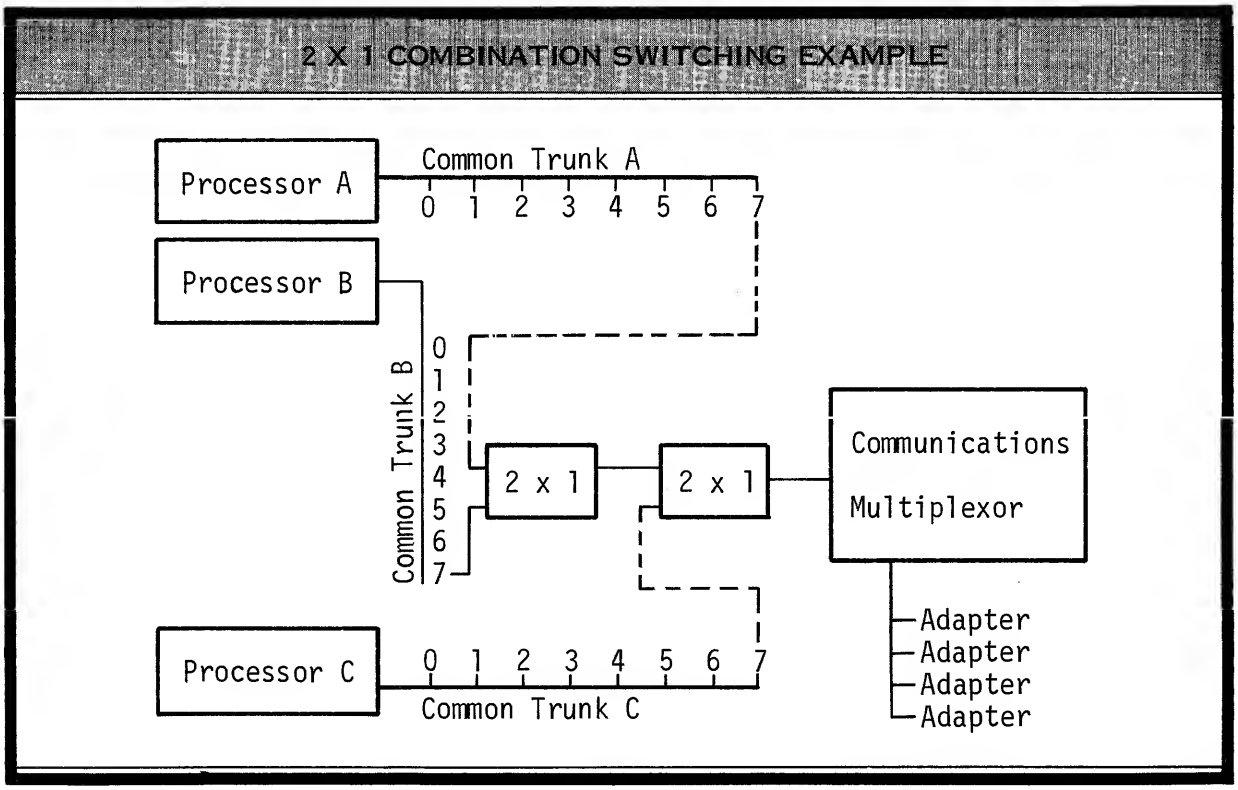
Although each pair of peripherals shown in these three examples uses only one position number, each peripheral might have its own position number.

COMBINATIONS OF SWITCHING MODULES

All three types of common trunk switching modules, 2 x 1, 2 x 2, and 1 x 2, can be interconnected in various combinations to produce series switching circuits. When switching modules are used in series circuits, the number of switches in the circuit must be limited to two.

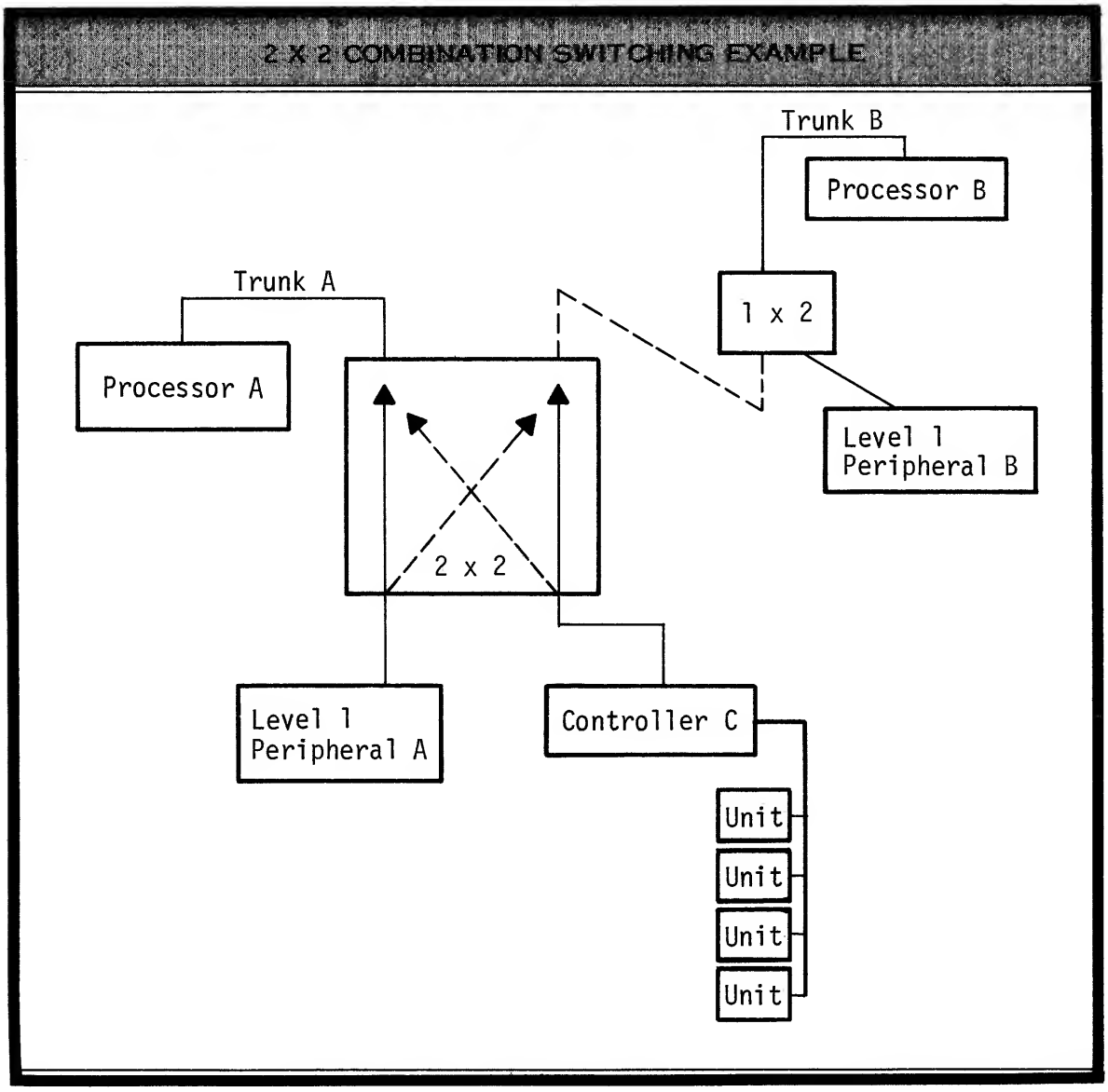
2 x 1 Module Combinations

The 2 x 1 switching module, normally used for switching a single peripheral between two trunks, can be used in conjunction with one additional 2 x 1 module to permit the location of a single peripheral at any of three trunk positions. The communications multiplexor in the illustration below can be connected to processor A, processor B, or processor C. It will always be at position 7.



2 x 2 Module Combinations

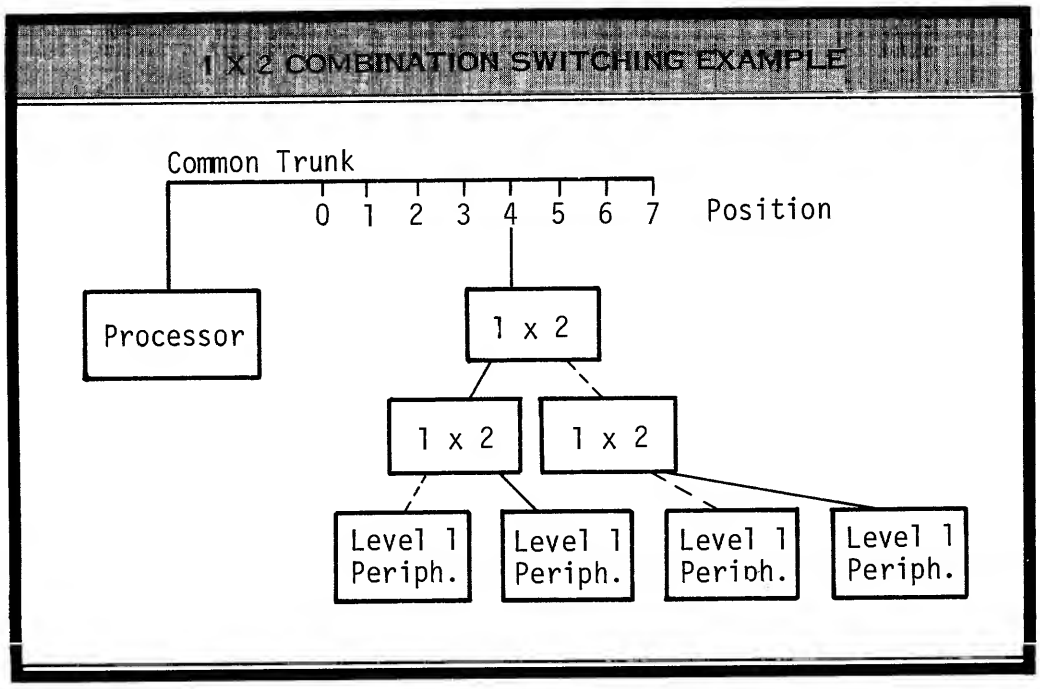
The 2 x 2 switching module is normally used to interchange the connections between two peripherals and two common trunks, as shown on page 6. The 2 x 2 module can also be used in combination with other modules. The sketch below is an example of such an arrangement.



Peripheral A can be connected to trunk A or to trunk B. Peripheral B can be connected to trunk B through the 1 X 2 switch. Controller C can be connected to trunk A or to trunk B. Only two of the three units can be connected to the three trunks at any one time.

1 x 2 Switching Module Combinations

An obvious combination of modules is a trio of 1 x 2 modules used for expansion of trunk positions. In the sketch below, the three switching modules expand the number of peripherals that can be used at position 4 of the trunk shown, from 1 to 4. Any of the four level 1 peripherals shown can be connected to trunk position 4.



NOTE

Although all four of the peripherals in the example are shown at the same position, they could have different position numbers.

SWITCHING AND CONTROL UNITS

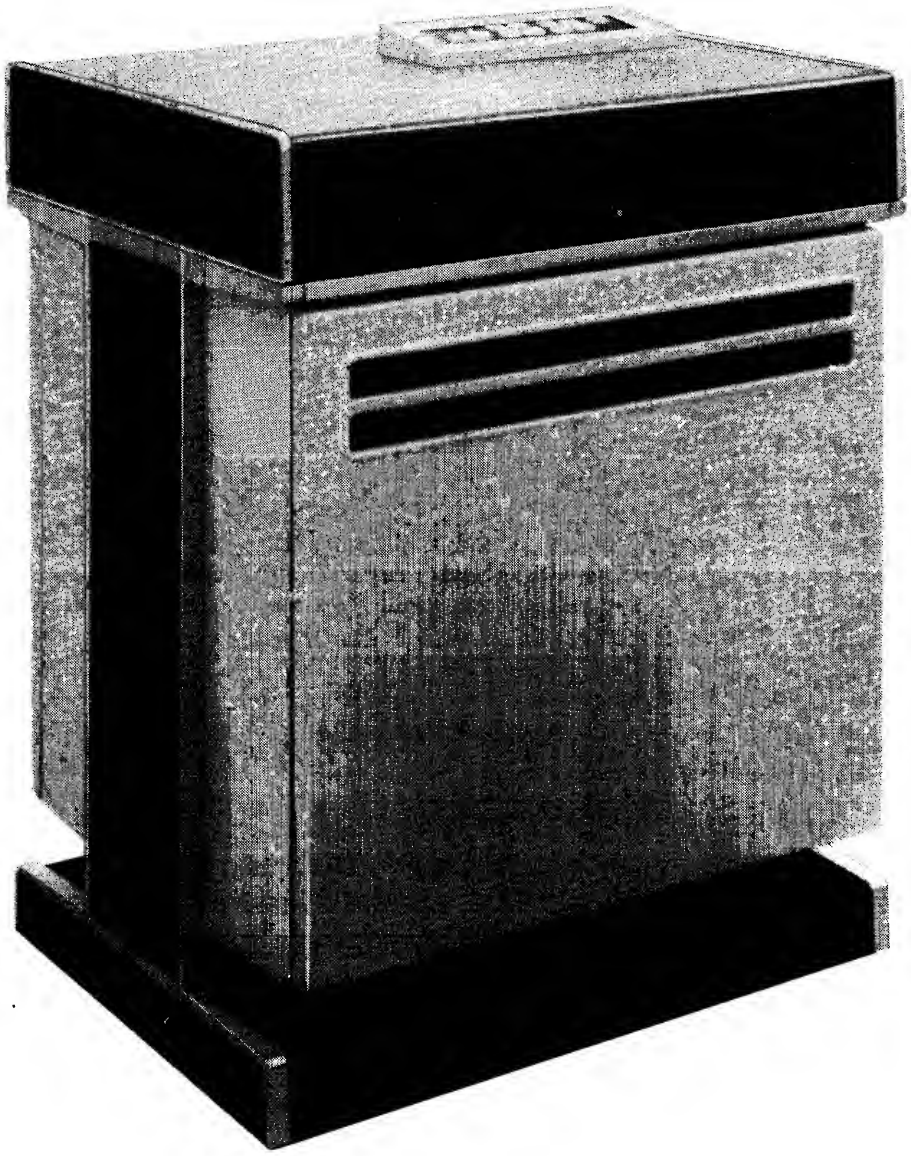
GENERAL INFORMATION

The 620 series includes two switching and control units:

- 620-301 Common Trunk Switching Unit
- 620-302 Central Switch Control Unit

Each unit can house one or two switching modules of any of the three types. The modules are powered by the units in which they are housed, and can be controlled from that unit or by remote control from some other unit. Switching modules of different types can be used in the same unit.

620-301 COMMON TRUNK SWITCHING UNIT



The 620-301 houses and powers one or two switching modules of any of the three types. Switching modules mounted in the 620-301 can be controlled from the 301 control panel or by remote control from the control panel of a 620-302. The uses of the switching modules were discussed in previous sections of this publication. This section discusses only the operation of a complete 620-301 common trunk switching unit. All of the unit's functions are explained in detail in the listing that begins on the next page.

The control panel of the 620-301 includes 6 controls and 5 indicators:

Controls

- POWER ON

  This switch is used to turn on the unit.

- POWER OFF

  This switch is used to turn off the unit.

- MODULE 1

  The MODULE 1 switch operates module 1. This control changes the state of module 1.

- MODULE 2

  This control is used to operate module 2.

- REMOTE/LOCAL Module 1

  This switch determines the source of control for module 1. When module 1 is controlled from the panel of the unit in which it is housed, it is said to be under local control. When it is controlled from some other unit in the system, it is said to be under remote control.

  A switching module can respond to local control or to remote control, but cannot respond to both simultaneously.

- REMOTE/LOCAL Module 2

  This control determines the source of control for module 2.

Indicators

- POWER ON

  This indicator lights when the unit is turned on.

- REMOTE/LOCAL Module 1

  This light indicates the source of control for module 1.

- REMOTE/LOCAL Module 2

  This light indicates the source of control for module 2.

- MODE, Module 1

  This light indicates the state of switching module 1.

- MODE, Module 2

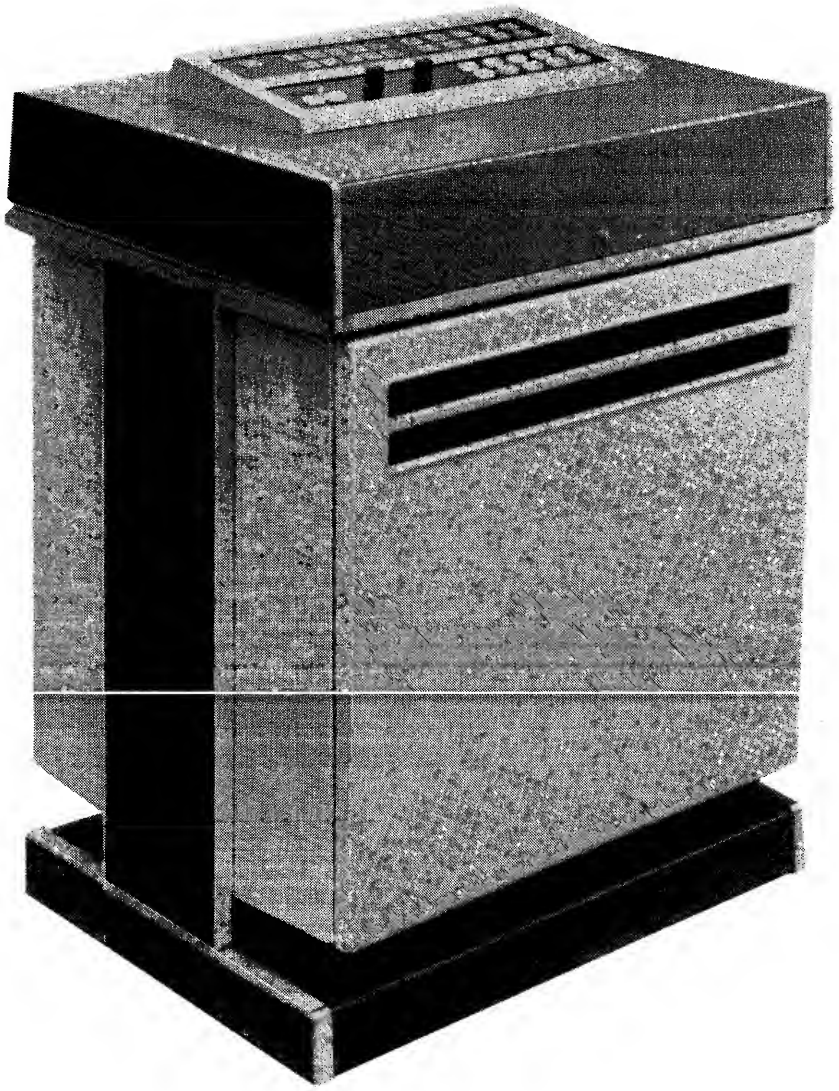
  This light indicates the state of switching module 2.

- SYSTEM LEGEND

  This indicator is available to identify two systems by color.

620-302 CENTRAL SWITCH CONTROL UNIT

The 620-302, like the 301, houses and powers two switching modules. In addition, the 620-302 includes facilities for control of up to 20 switching modules, 18 of which must be mounted in other units.



The 620-302 control panel includes unit controls, individual switching module controls, configuration controls and indicators. All of the unit's functions are discussed in the following pages under the appropriate control headings.

Unit Controls

- POWER ON

  This control turns on the unit.

- POWER OFF

  This control turns off the unit.

Individual Switching Module Controls

Ten pushbutton controls are provided for operation of 10 switching modules located at various points in the system. Two of these switching modules can be mounted in the -302, although they need not be. By use of these 10 controls, each of the 10 switching modules can be set to either of its two positions. Switching modules mounted in other units must be placed under remote control in order to be operated from the 620-302.

Configuration Controls

The 620-302 is equipped with two configuration controls. Each of these can be used to set a combination of 1 to 5 switching modules to either of two predetermined patterns. This means that as many as 10 additional switching modules can be controlled from the 620-302.

Indicators

- POWER ON

  This indicator lights when the unit is turned on.

- Switching Module Indicators

  Twenty indicators are provided to display the condition of the 20 switching modules that can be controlled by the 620-302.

SYSTEM CONSTRAINTS

SYSTEMS COMPONENTS

The switching modules are designed to interface only with NCR Century processors and level 1 peripherals.

Processors

The switching modules will interface with any trunk of any NCR Century processor. The switching modules cannot switch integrated peripherals.

Level 1 Peripherals

A level 1 peripheral is one which interfaces directly with the common trunk, and which does not require a separate control unit. The switching modules can interface with any level 1 peripheral except integrated peripherals, which share some logic and power with the processor and cannot be switched.

CABLING CONSIDERATIONS

Cable Lengths and Time Delay

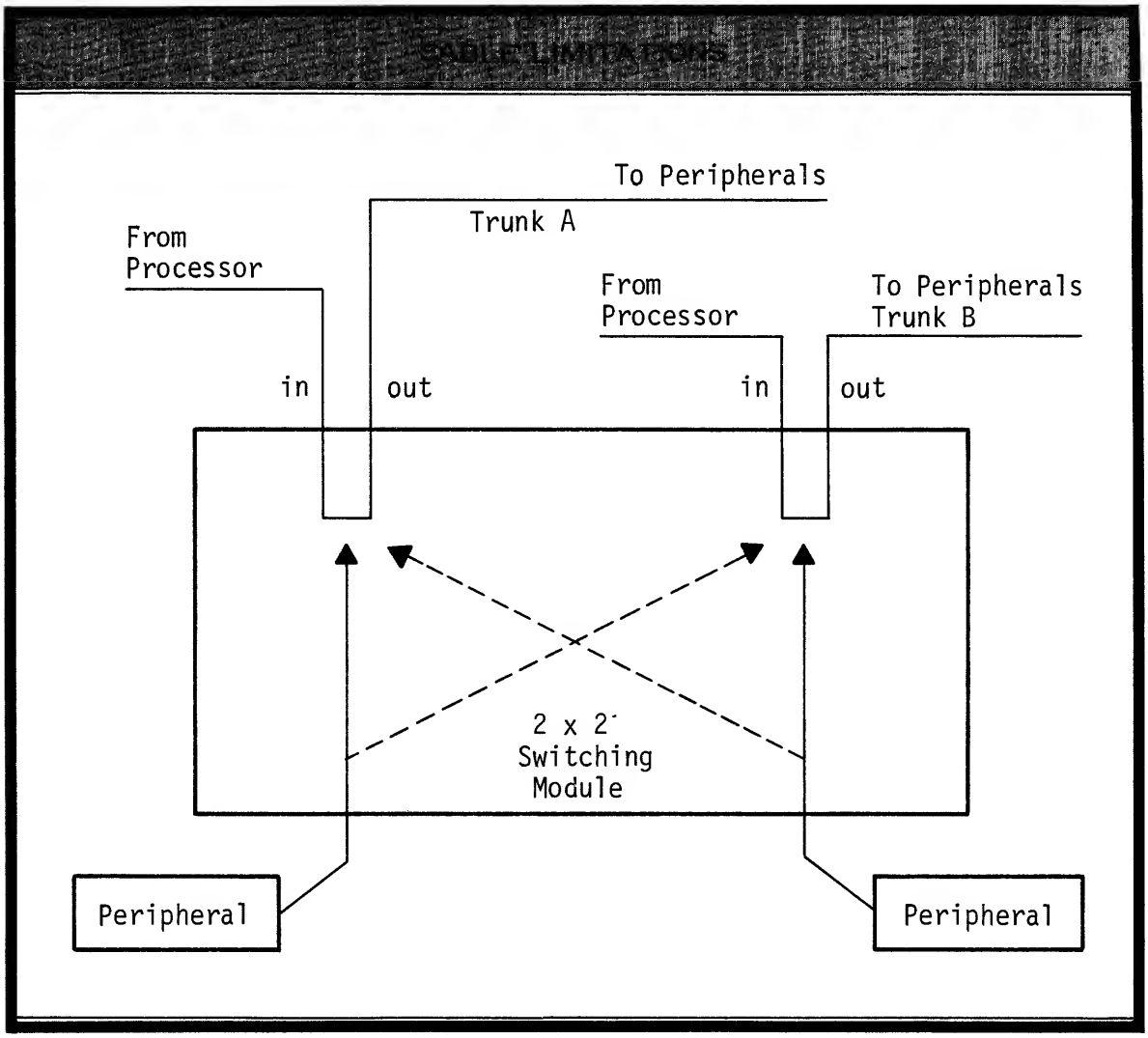
Each switching module inserts into the common trunk segments switched by it a signal delay time equivalent to that produced by about fifteen feet of common trunk cable. The maximum trunk lengths of 100 feet (for a standard trunk) and 50 feet (for a high speed trunk) must, therefore, be reduced by fifteen feet for each module through which the trunk passes.

Series Switching Circuits

Common trunk switching modules should not be arranged in series circuits which force data and signaling information through more than two modules. Timing delays and line conditions are such that a series circuit involving more than two modules may cause faulty peripheral operation or loss of data.

Use of Raceways

The size of a raceway limits the number of cables that can be connected to the switching modules within a switching unit. The limitation is diagrammed on the next page.



Although the 2 x 2 switching module is shown connected to two trunks, four cables are required: two IN cables, and two OUT cables. In addition, two cables are required to connect the switching module to the two peripherals. Thus, six cables are required for each 2 x 2 switching module. If two 2 x 2 modules are fully used, in a single unit, 12 cables are needed. Cable raceways cannot be used with such a unit, since the size of the raceway limits the number of cables to 8. This limitation may also be encountered with the 1 x 2 and 2 x 1 switches.

SOFTWARE CONSIDERATIONS

NCR Century software requires a record of the trunk and position locations of the various peripherals in the system. This record, which is used by system software to locate the peripherals needed for execution of input and output operations, is maintained in the form of a table in memory, and is called the peripheral availability list (PAL). When peripherals are changed or moved, by use of the 620 equipment, the PAL must be updated to reflect current peripheral locations. There are three control instructions that can be used to make or alter PAL entries:

- PALENT Instruction

  This instruction is used to make a complete entry to the PAL. Each entry includes all of the data necessary for software to access and use the peripheral.

- SYSPER Instruction

  The SYSPER instruction is used to tag a given peripheral as a "system peripheral." A system peripheral is one which is used for storage of operating system software.

- DIAL Instruction

  The DIAL instruction is used to interchange the symbolic unit designators (SUD) of two peripherals. This instruction, in effect, tells software that peripherals X and Y have exchanged places.

For detailed explanations of the PAL, refer to publication ST-9543-10, MONITOR, DESCRIPTION AND FUNCTIONS, in the OPERATING SYSTEMS binder. The SYSPER and DIAL control instructions are discussed in publication ST-9453-15, MONITOR, CONTROL INSTRUCTIONS, in the same binder.